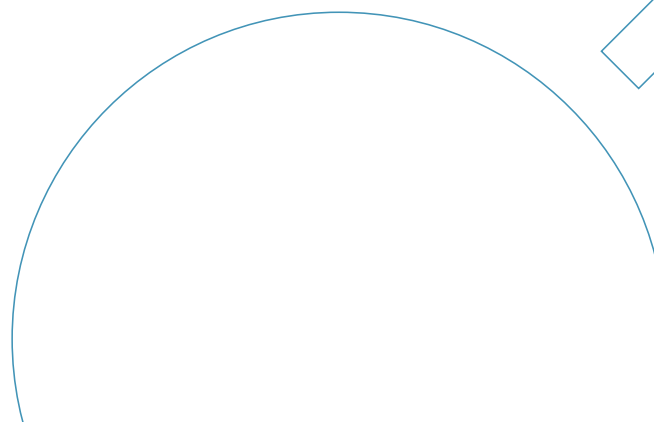


Is Bigger Always Better? Modal Shift Through Freight Disaggregation

Dr. Jake Russell
ARPA-E Fellow

May 23, 2022



Current intermodal system relies on truck for middle mile

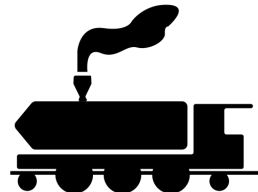
Long Haul

1000+ miles



Middle Mile

50-1000 miles

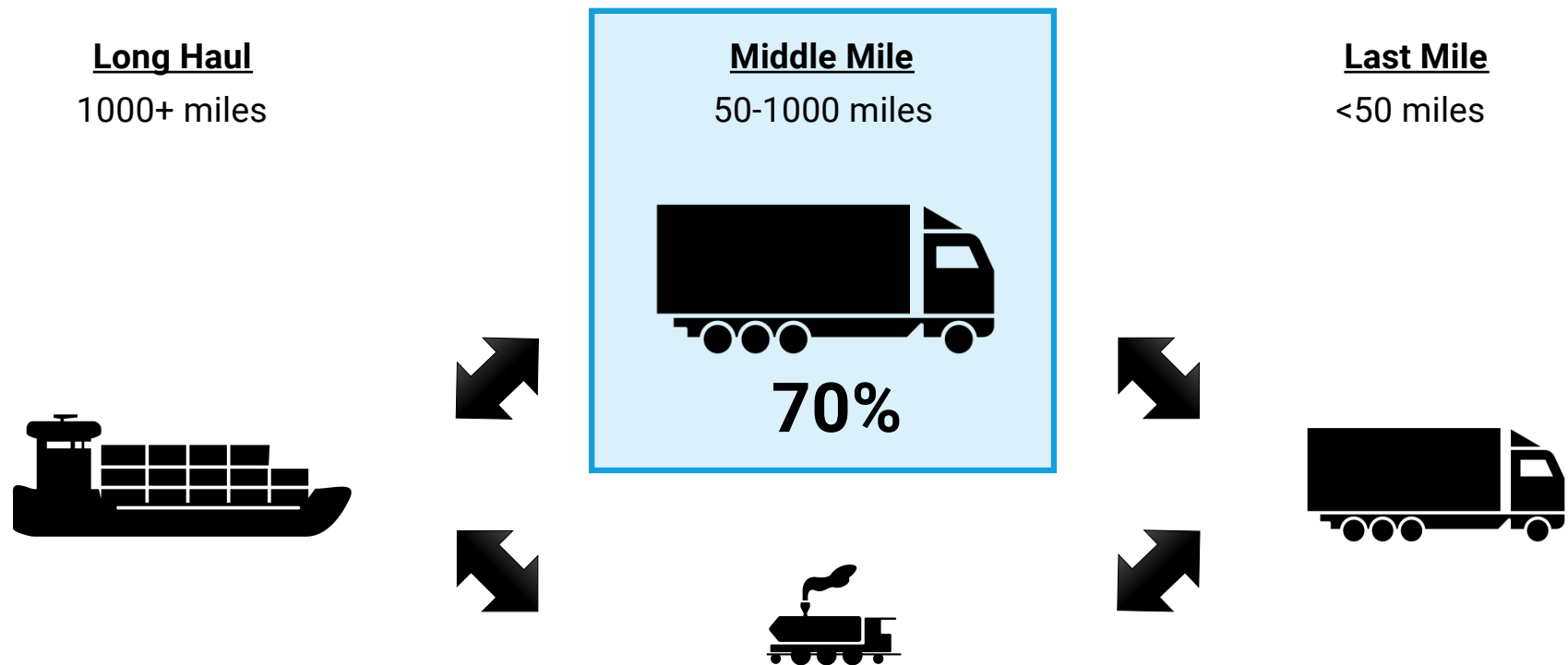


Last Mile

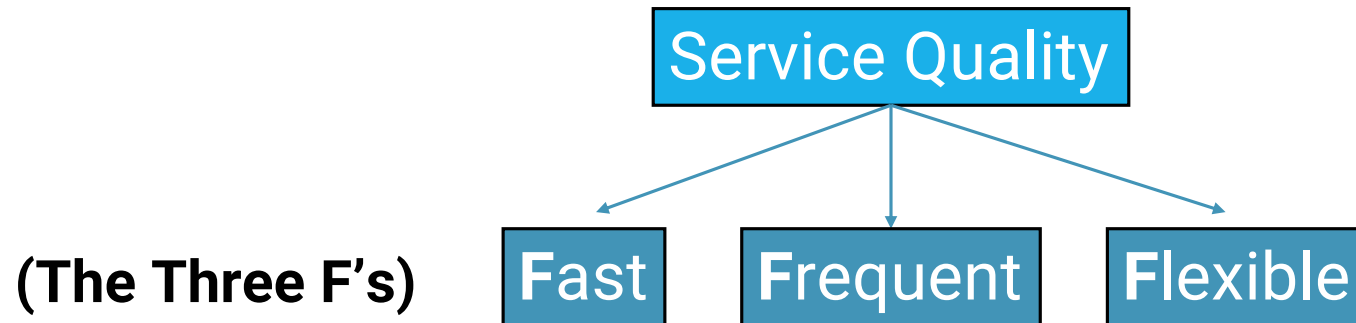
<50 miles



Current intermodal system relies on truck for middle mile



Trucks provide excellent service quality

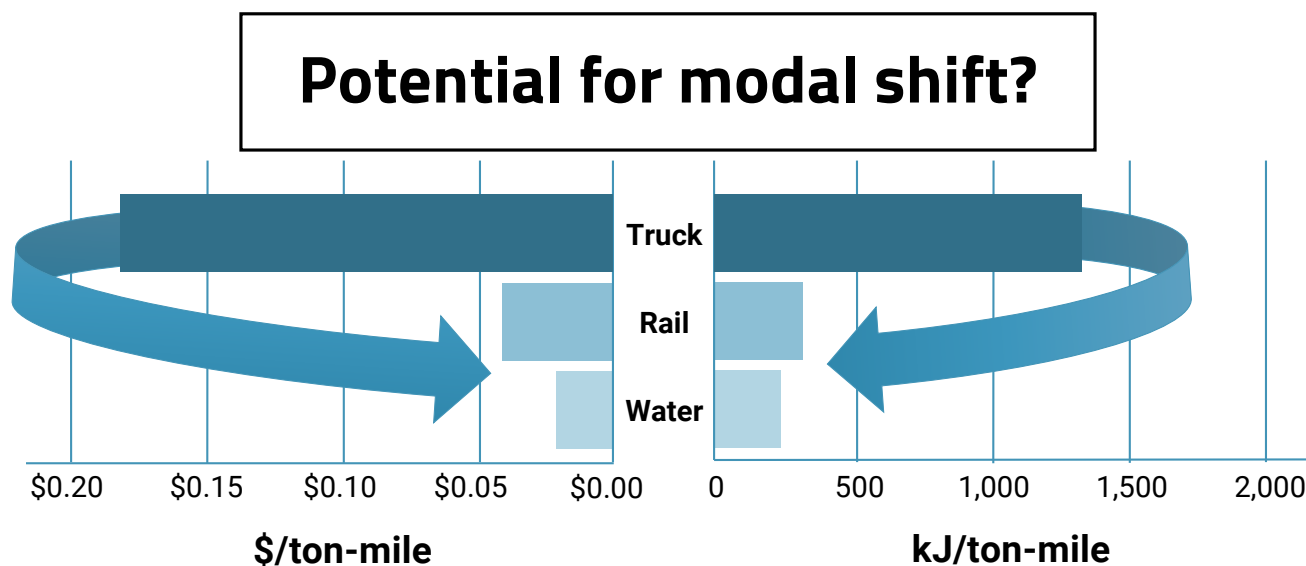


Last mile delivery →

← Modularity

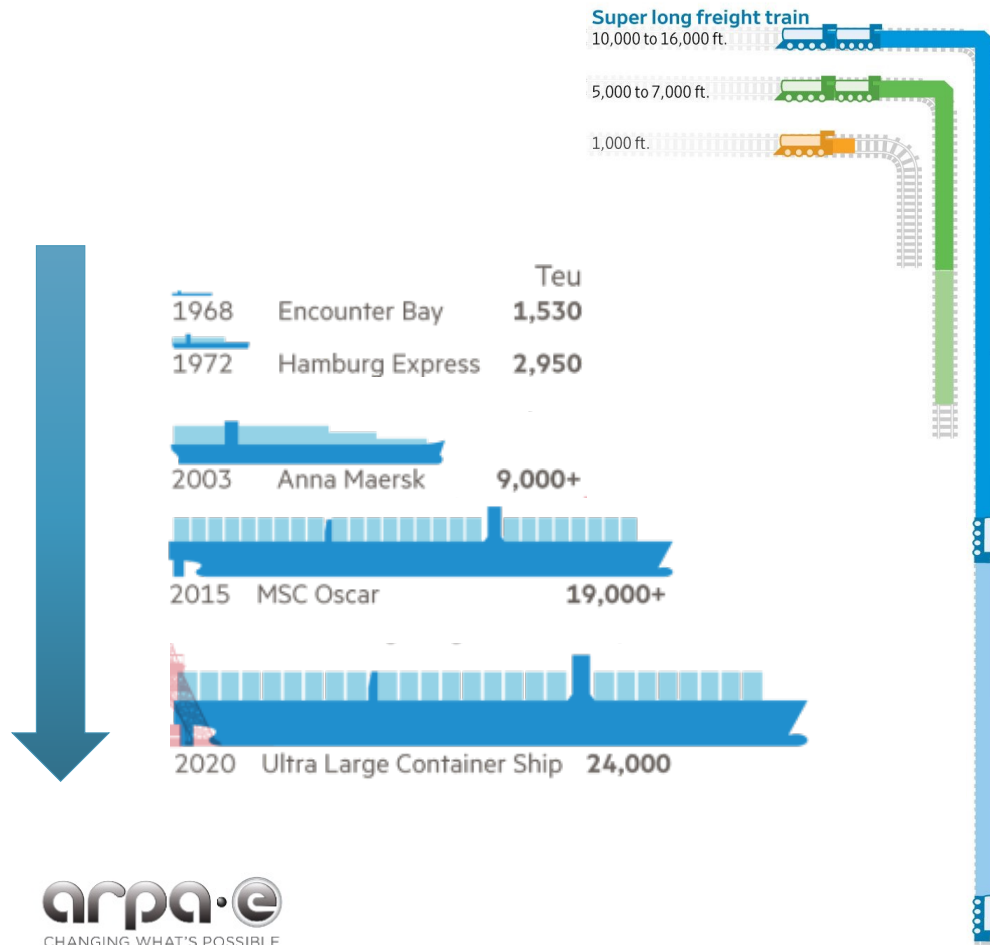


But trucking is an inefficient and expensive mode...

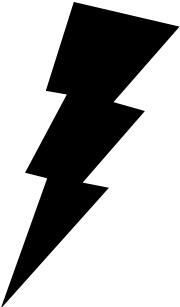


...resulting in over 5% of total US energy use.

Historically, freight aggregation enabled differentiation from trucking




**Labor
Efficiency**

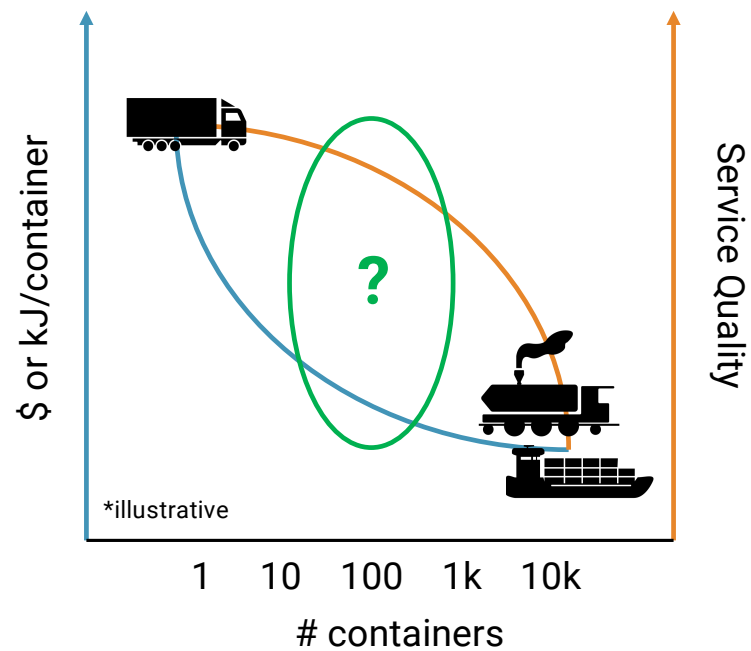

**Energy
Efficiency**

Financial Times
Wall Street Journal

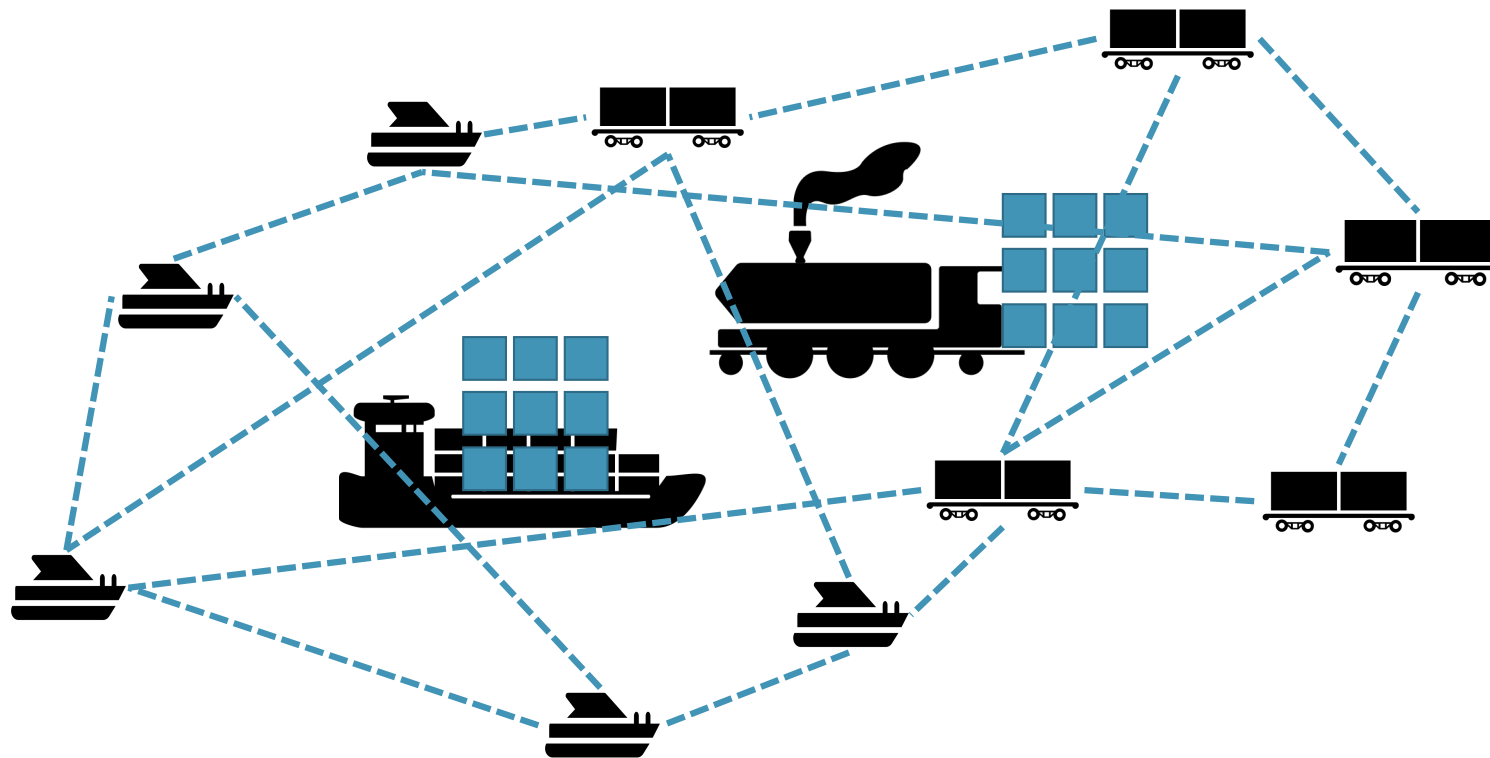
But increasing aggregation also comes with drawbacks



Current middle-mile options: two opposite ends of the spectrum

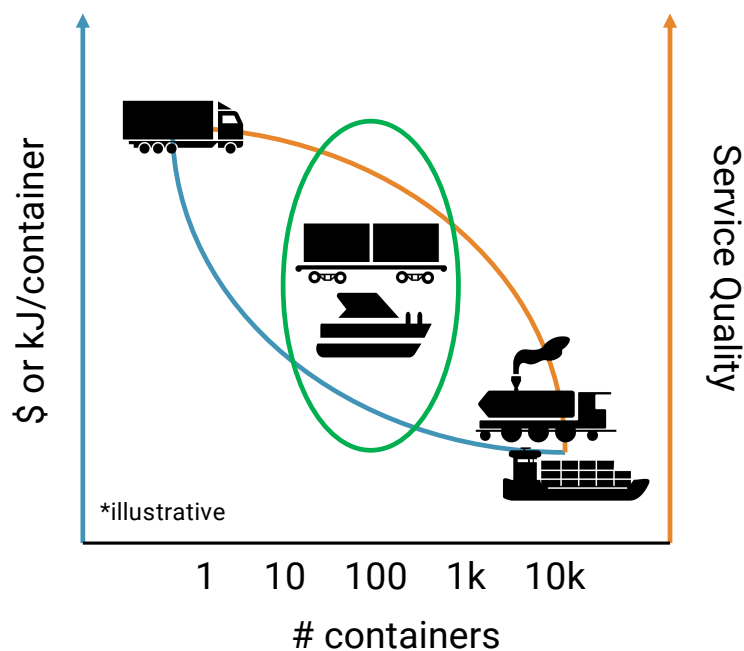


Disaggregation: Breaking it down



Disaggregation could find sweet spot of service quality and efficiency

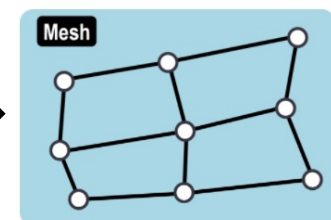
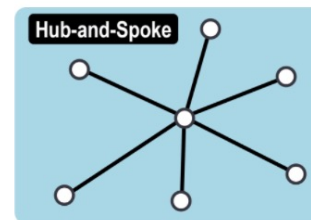
- ▶ A **third option** for freight transport: smaller, speedier chunks with the efficiency of aggregated modes



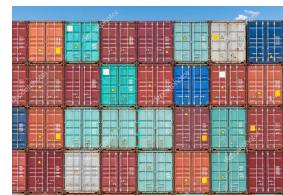
1. Efficiency



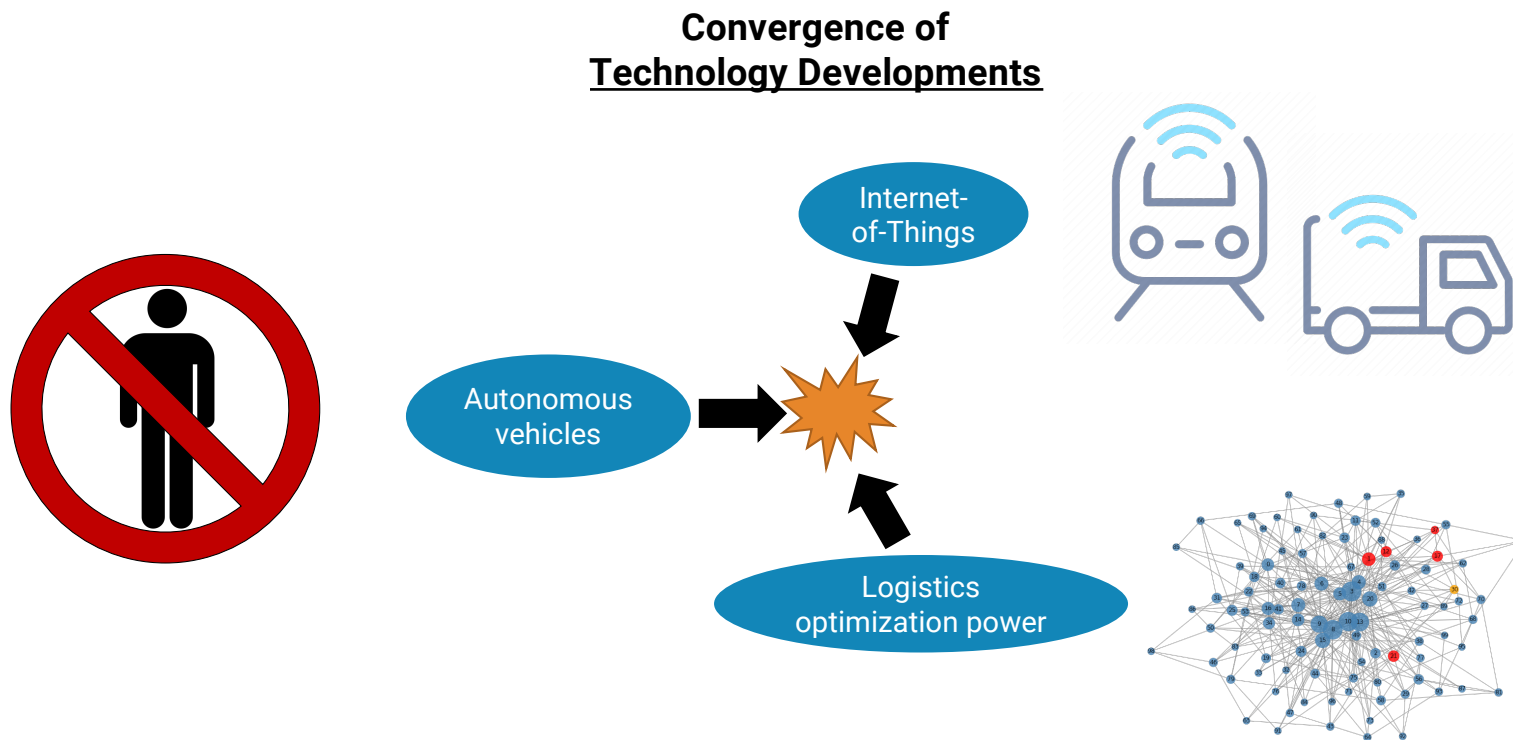
2. Resilience



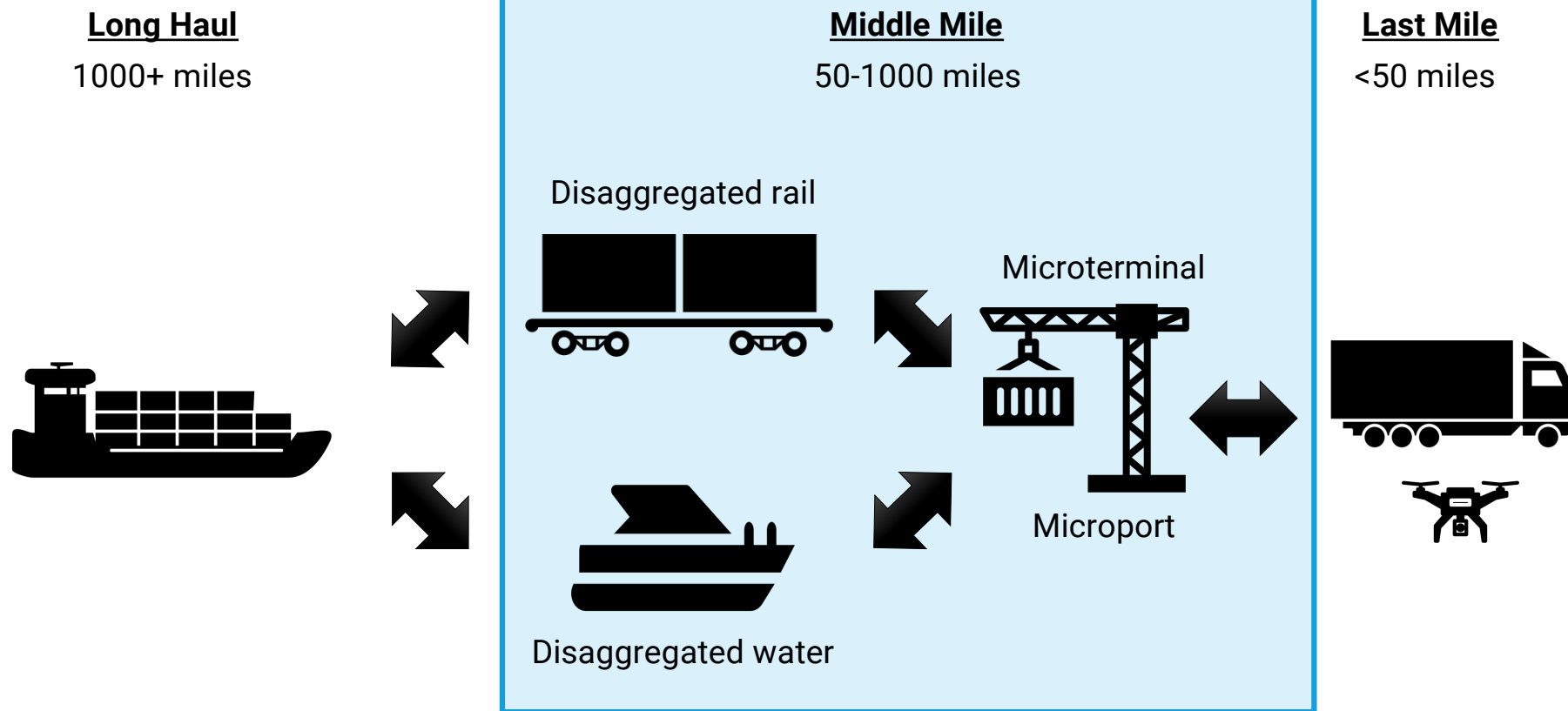
3. Modularity



Connectivity and autonomy enable the transition



Visions of a disaggregated intermodal future



Visions of a disaggregated intermodal future

Long Haul

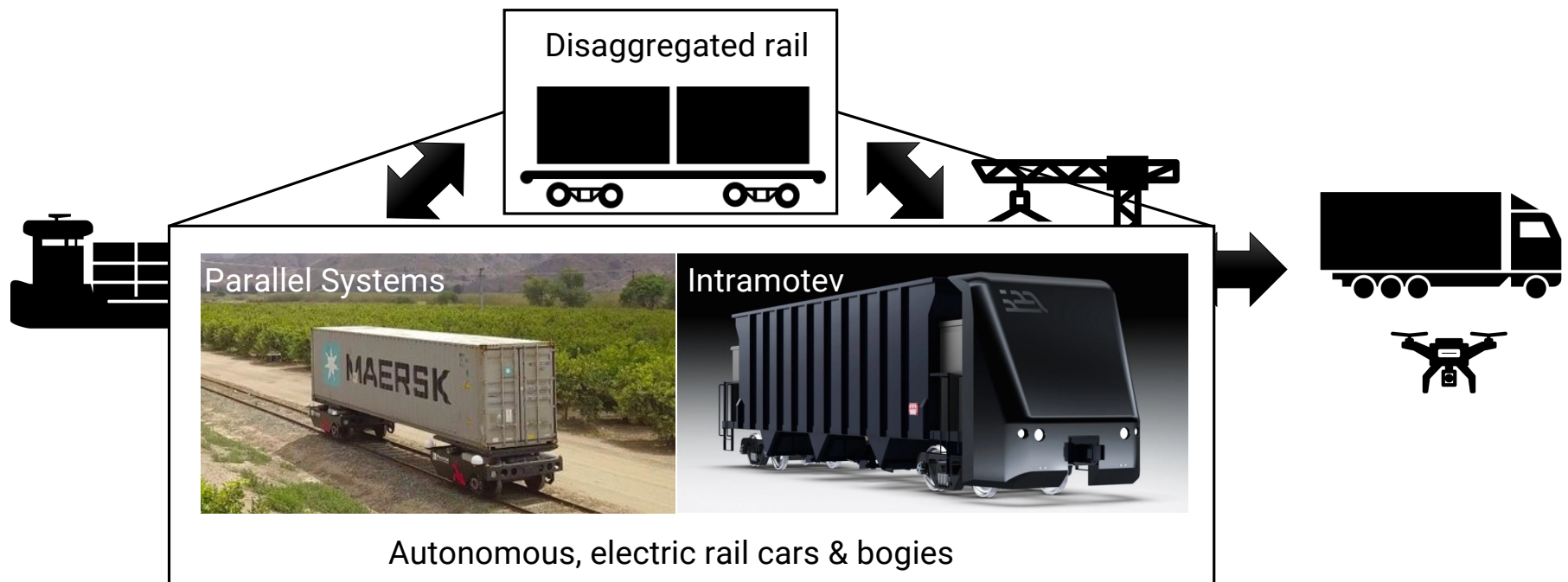
1000+ miles

Middle Mile

50-1000 miles

Last Mile

<50 miles

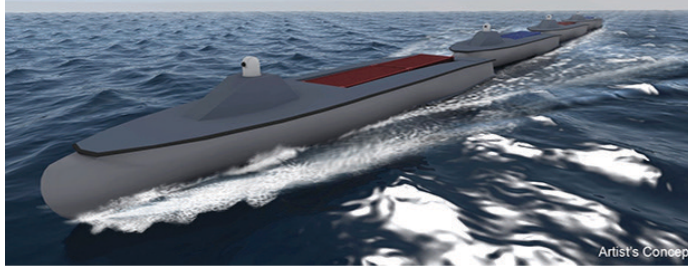


Visions of a disaggregated intermodal future

Long Haul

1000+ miles

Sea Train - DARPA



Middle Mile

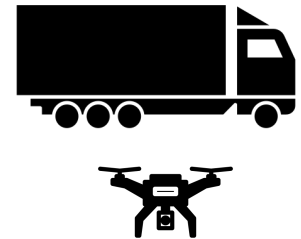
C. Nordstrom
SEASLED



Autonomous ship & barge convoys

Last Mile

<50 miles



Disaggregated water

Visions of a disaggregated intermodal future

Long Haul

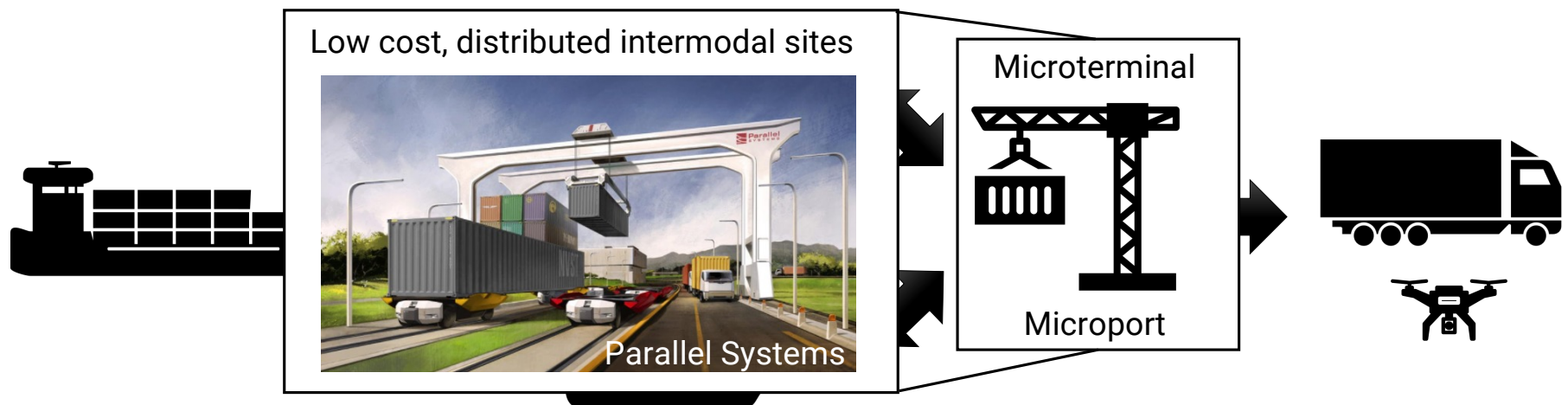
1000+ miles

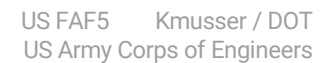
Middle Mile

50-1000 miles

Last Mile

<50 miles

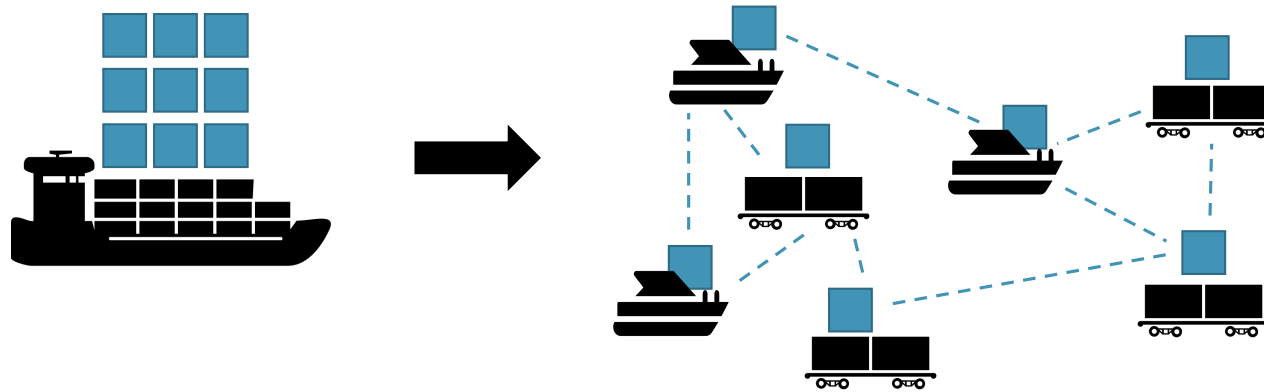




New paradigm: Bigger is not always better

- Energy reduction via **modal shift** from trucking to rail/water

- Increased **resilience** and **performance** of intermodal system



Modular
Autonomous
Connected

=

Fast
Frequent
Flexible



Let's Get Moving!

Dr. Jake Russell

ARPA-E Fellow

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